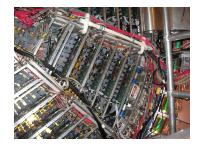


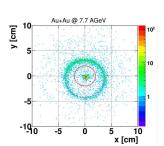
Changes for Run 10

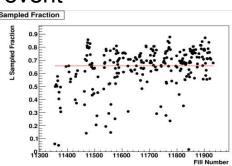


- Completed installation of TOF
 - All 120 trays installed prior to run 10



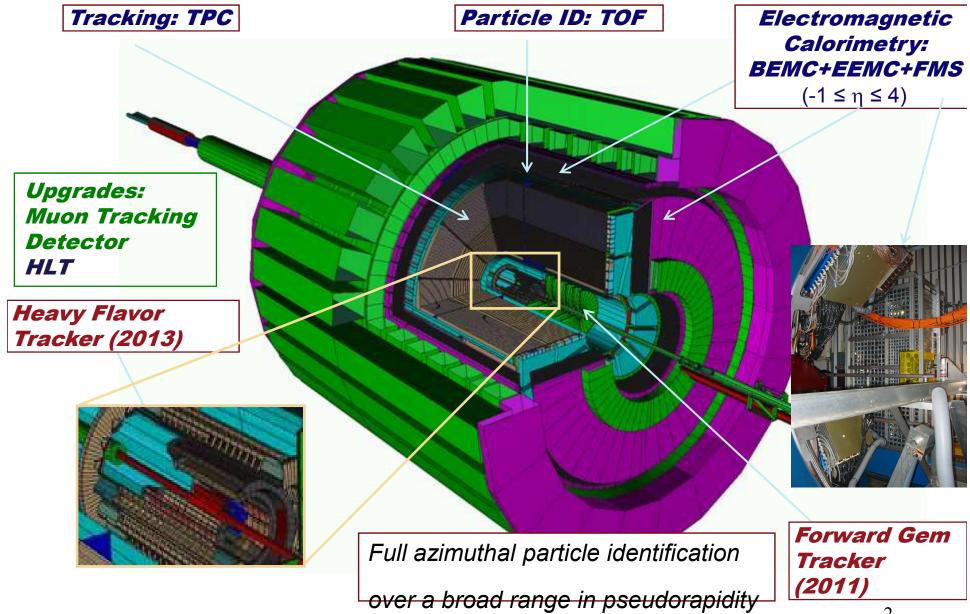
- New Barrel Shower Maximum Detector (BSMD + BPRS) readout
 - Installed prior to run 10
 - Allows to run STAR physics at 500 Hz with dead time only ~ 17%
- Operational optimization
 - Laser calibration events taken in parallel with physics event
 - Pedestals taken once per day
 - No need to reconfigure trigger
 - 15% increase in luminosity sampling efficiency
- Extensively used High Level Tracking Trigger
 - QA during Beam Energy Scan
 - Online event selection





STAR: A Correlation Machine



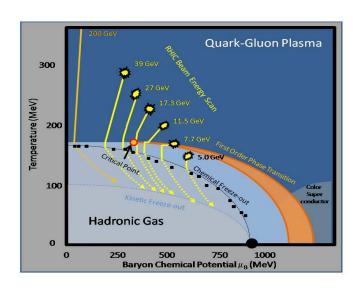


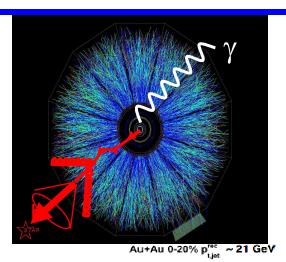
Motivation

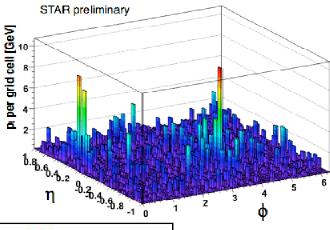


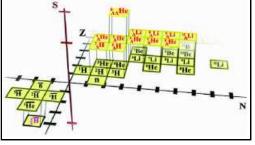
• Run 10

- Quantitative studies at AuAu 200 GeV with high statistics sample and latest detector upgrades
- Search for the QCD
 Critical Point in AuAu









3

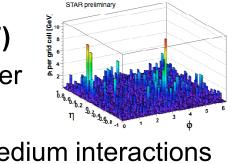
Physics at AuAu √s_{NN} = 200 GeV



- Triggered: 2 nb⁻¹ sampled (x4 vs. Run 7)
 - Non-photonic electrons with low material
 - Quarkonia: Upsilon and high-p_T J/Ψ with low material
 - γ-hadron: hadron z_T ~0.3 at hadron p_T ~5 GeV/c to distinguish E_{loss} scenarios
 - Triggered fully reconstructed jets for jet-jet and identified jet-hadron correlations

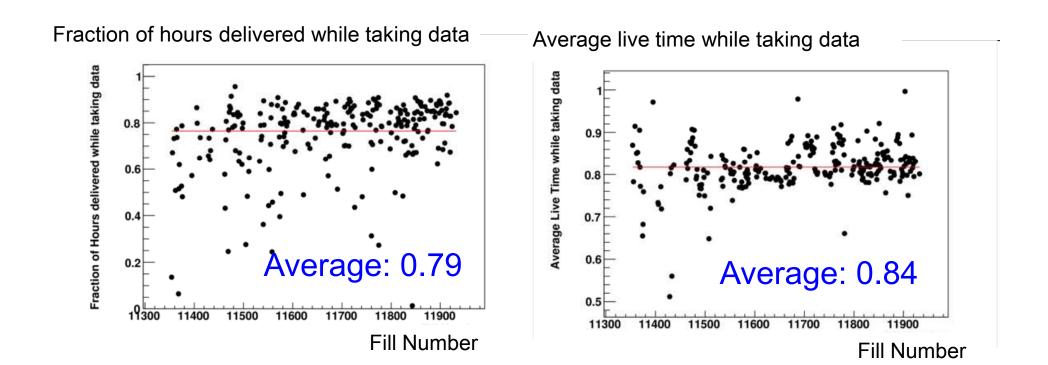


- Extension of fully reconstructed jets, unbiased by trigger
 to 40-50 GeV
- Di- and tri-hadron identified particle correlations: jet-medium interactions
- Minimum bias: 300M (x4 relative to Run 7)
 - Jet conversion via K for p_T>10 GeV/c
 in peripheral collisions
 - Low-mass dileptons with low material
 - 10σ measurement of hyperon and anti-hypertriton production



Efficiency at AuAu 200 GeV

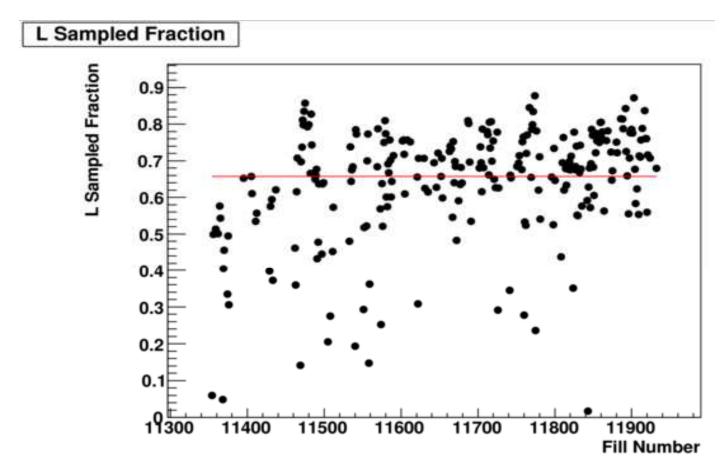




Typical DAQ rate 500 Hz

Luminosity sampled by STAR

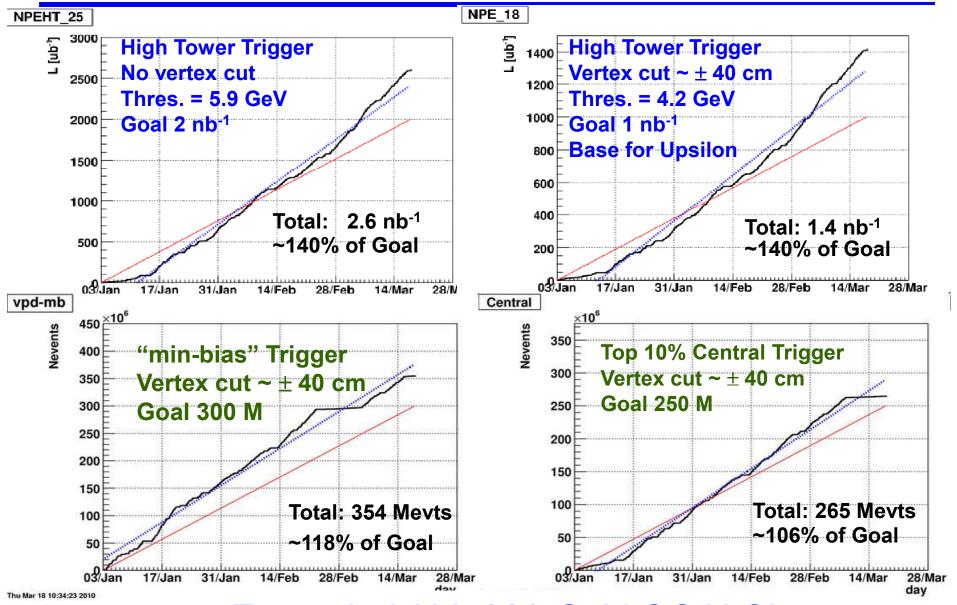




- Average of Delivered luminosity samples is 65.7%
 - includes: live time, turning on/off, problems, pedestals, commissioning ...

STAR data summary AuAu 200

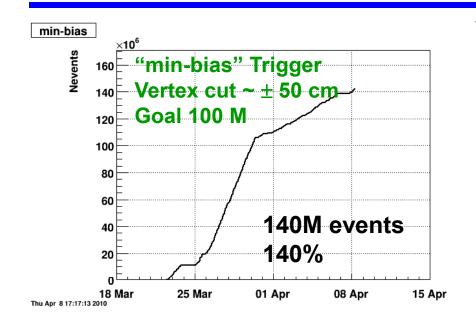


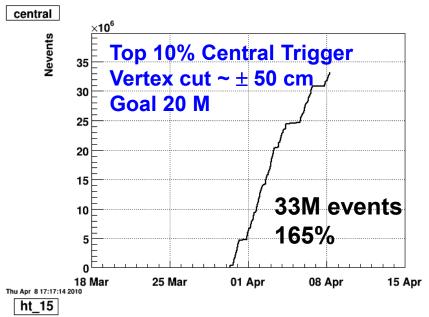


Exceeded ALL 200 GeV GOALS!

STAR data summary AuAu 62

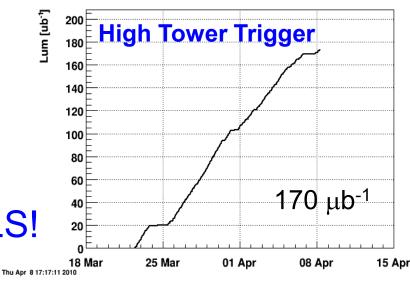






- Smooth running
- Performance
 - Live 82 %
 - Sample 60%

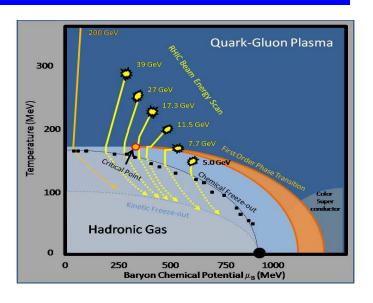




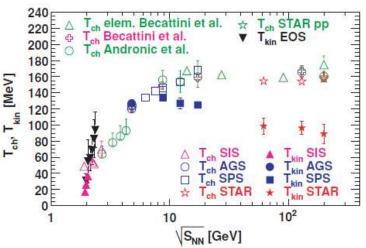
Critical Point Search in Run 10



- Search for phase transition signatures and for signatures of the critical point
 - Elliptic & directed flow
 - Azimuthally-sensitive femtoscopy
 - Fluctuation measures
- Search for turn-off of new phenomena seen at higher RHIC energies
 - Constituent-quark-number scaling of v₂
 - Hadron suppression in central collisions
 - Ridge
 - Local parity violation
 - At higher RHIC energies T_{ch} is constant.
 Moving to sufficient low collision energy, expect T_{ch} to be smaller and vary with centrality. Study this variation in BES.



STAR Note SN0493 STAR: Phys. Rev. C 81, 024911 (2010)

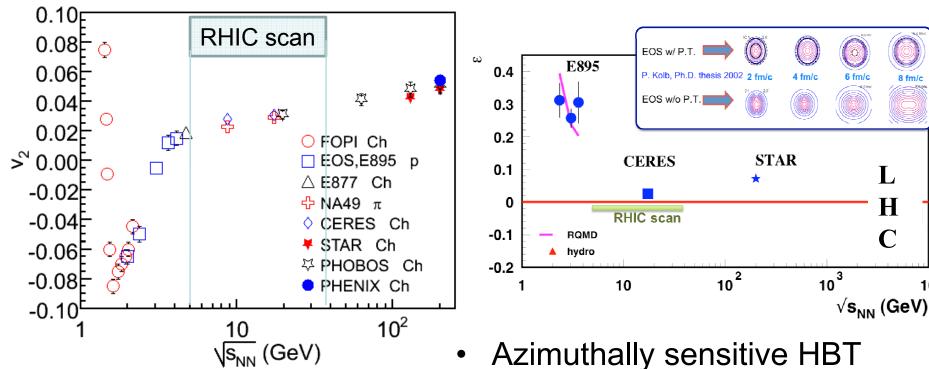


STAR: Phys. Rev. C 79 (2009) 034909

Flow and HBT



H

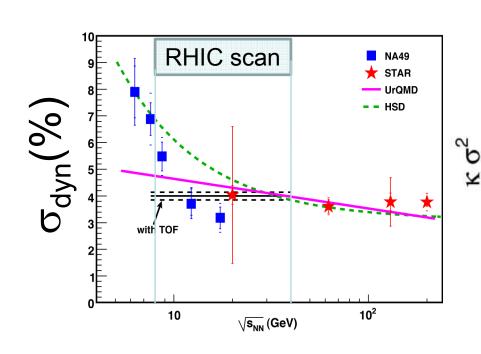


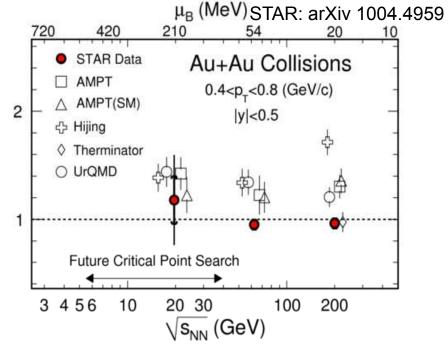
- Sensitive to early pressure
- Search for soft point of EoS
- Non monotonic excitation function
- Sensitive for softest point of EoS

Signatures of 1st order phase transition 10

Fluctuations







- Example of PID fluctuations
- Fluctuations maximized near the critical point

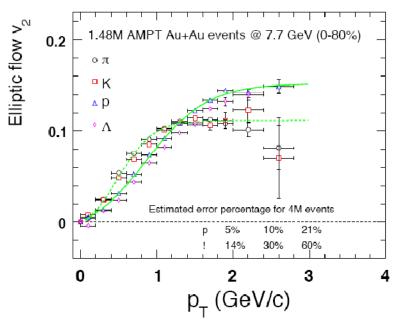
STAR: Phys. Rev. Lett. 103 (2009) 92301

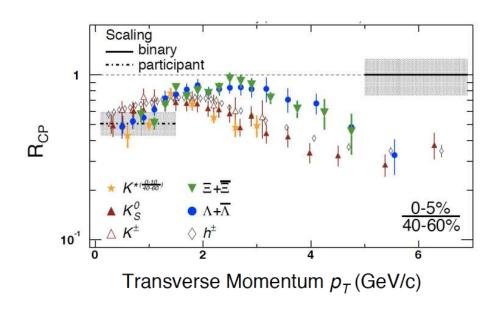
Signatures of CP

Product of Kurtosis x variance of netproton distribution as a function of beam energy. The observable is sensitive to long range correlations as expected from QCD Critical Point (CP). Comparison with models and the lack of non-monotonic dependence of the observable with beam energy shows CP is absent in the measured energy range.

Scaling and Suppression







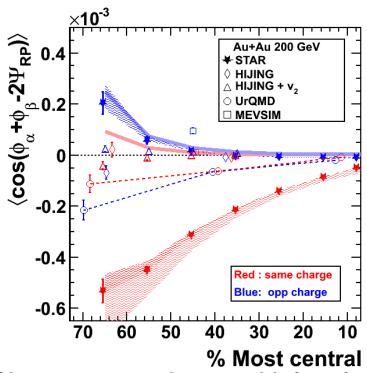
- v₂ scales as n_q → partonic degrees of freedom
- Where does it break down?

STAR: Phys. Rev. C 77 (2008) 054901

- Suppression at intermediate p_T depends on quark number
- Suppression at high p_T is an indication of opacity

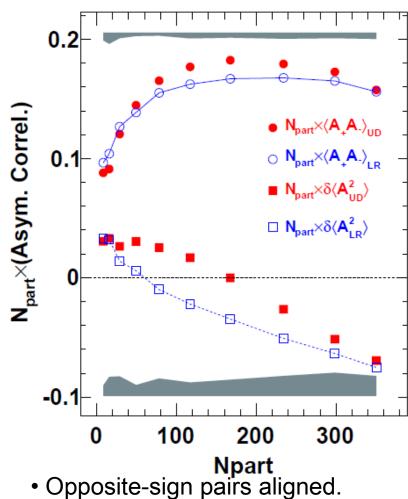
Local Parity Violation Signatures





- Signature consistent with local parity violation at 200, 62 GeV
 - Measure Parity Even
 - Look for evolution as function of energy
 - No background found to date that can mimic effect
 - Background expected to change with

energy STAR: Phys. Rev. Lett. 103 (2009) 251601

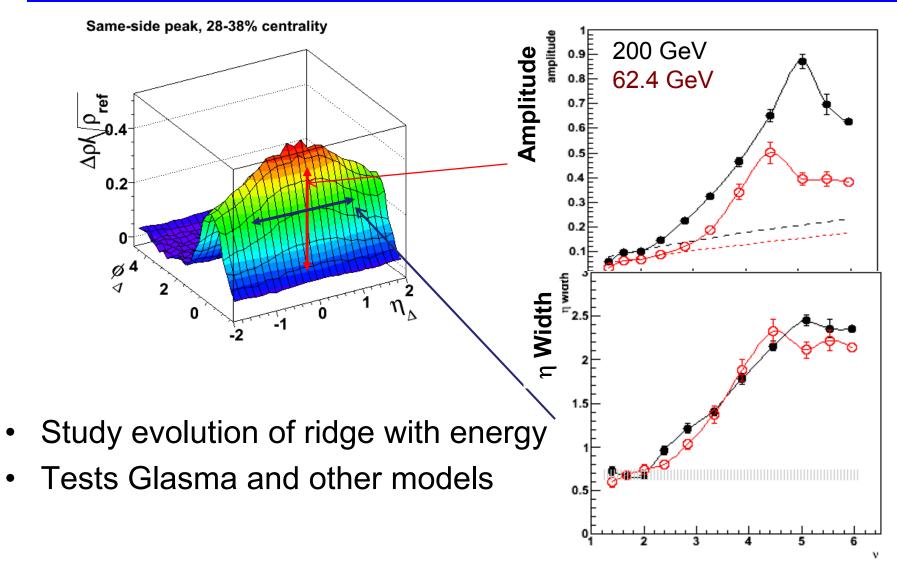


- Same-sign back-to-back in central.
- Alternate approach to understand the underlying physics. 13

Please see talk by Fugiang Wang

Ridge





Glauber linear superposition scalling

Critical Point Search Program



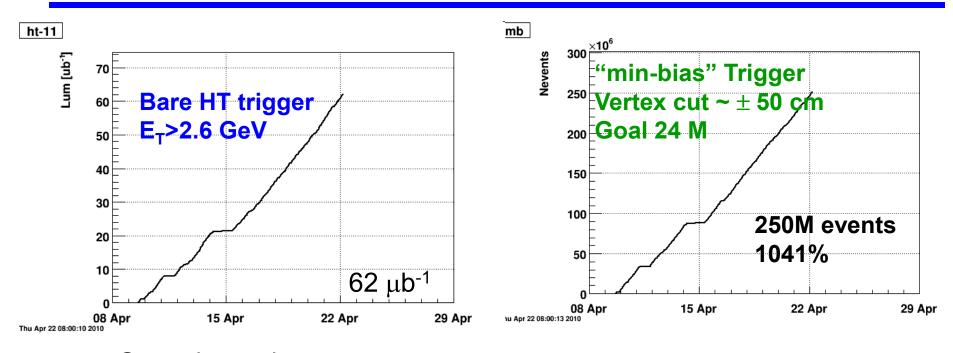
Beam Energy	μ _Β (MeV)	Events proposed	Acquired	
5	550	(100 k)	Not Done	_
7.7	410	5M	5.014M	
11.5	300	5M	7.795M	
17.3	230	15M	Not Done	
27	150	33M	Not Done	
39	110	24M	250M	

Conservative estimate of rates and hours/day

Expected range of Critical Point: $\mu_B = 150-600 \text{ MeV}$

STAR data summary AuAu 39 GeV





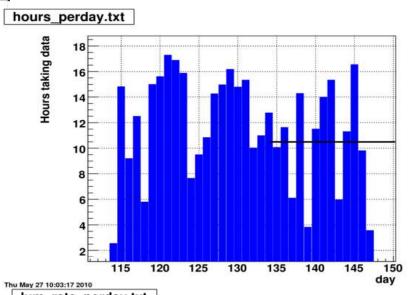
- Smooth running
- Great performance
 - Average live time ~78%
 - Fraction of sampled luminosity ~60%

Exceeded ALL 39 GeV GOALS!

STAR data summary AuAu 7.7 GeV

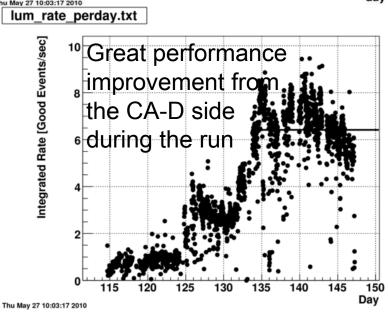






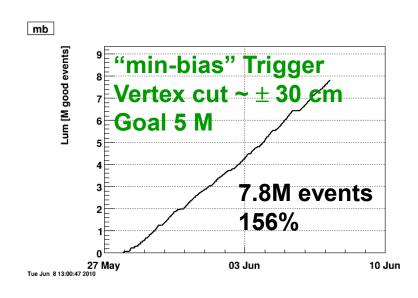
- Collected 5.014 M events
- Operated in 10 minutes stores environment
- Average uptime ~ 11 hours
- Collecting up to 350 k events per day

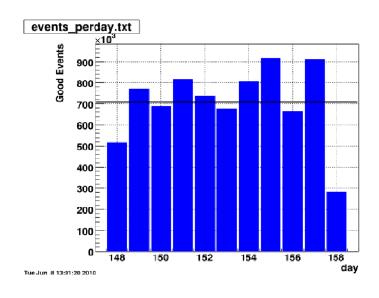
Met 7.7 GeV GOAL!



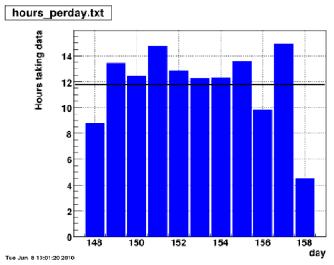
STAR data summary AuAu 11 GeV







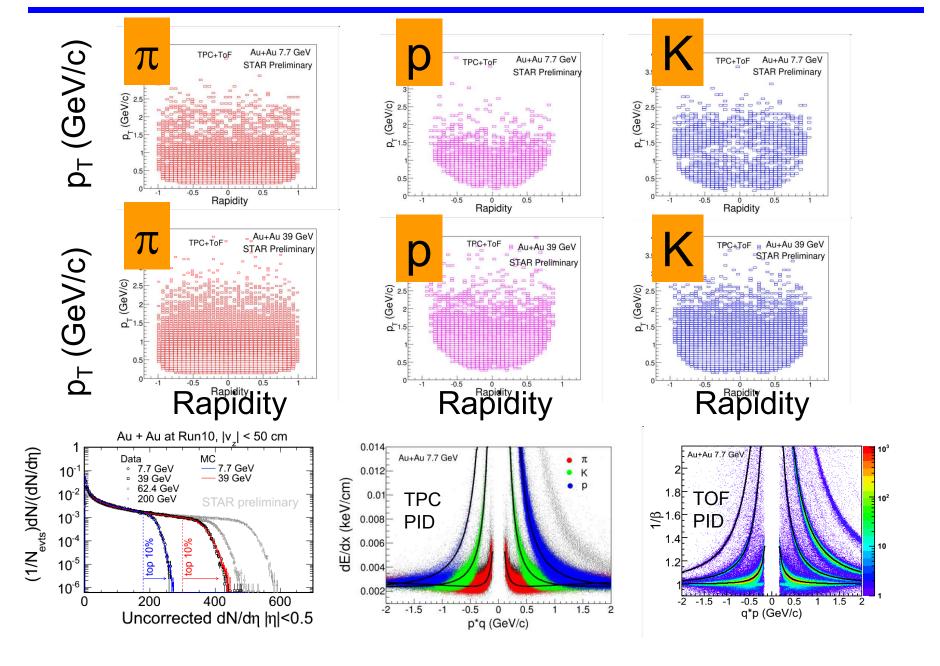
- Collected 7.795 M events
- Taking data 12 hours per day
- Up to 900K events per day



Exceeded 11 GeV GOAL!

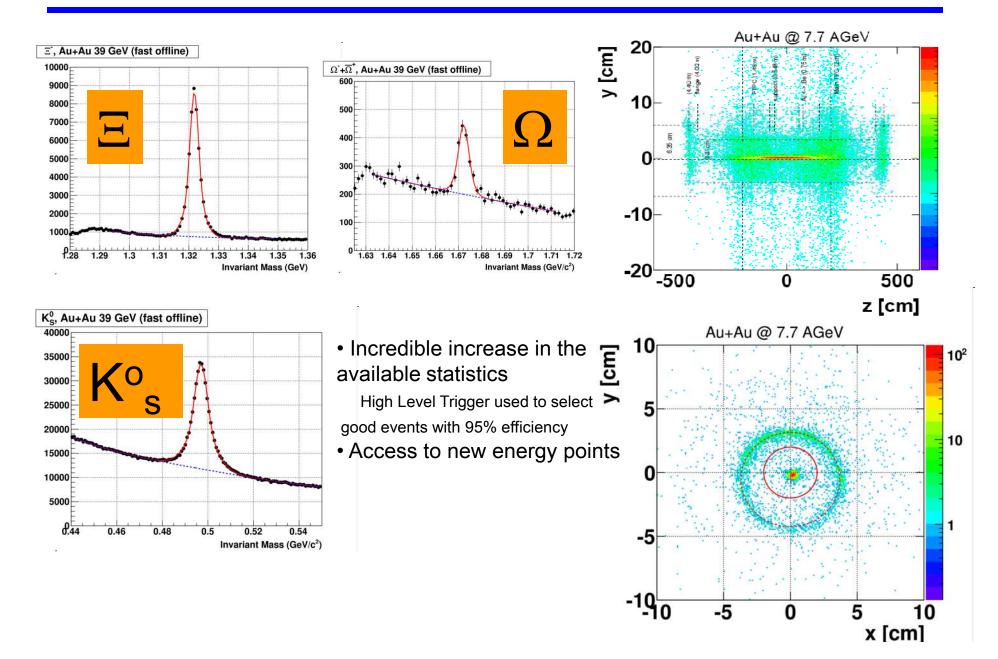
STAR Performance in Run 10 at 7.7 & 39





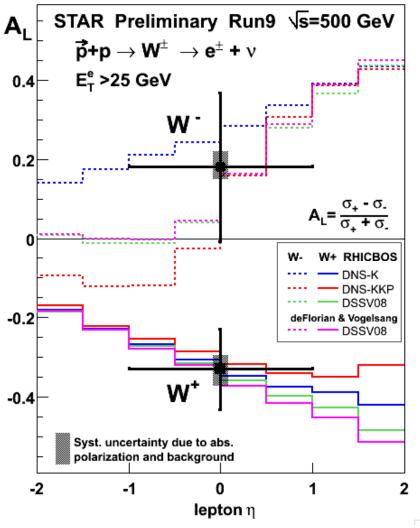
Preliminary Results from Run 10





Towards Run 11





STAR Preliminary Run 9 (p+p √s=500 GeV)

Parity-violating single-spin
asymmetry W+/W-A₁ results

- Complete the phase-I Beam energy Scan (BES) program at RHIC.
 - Remaining beam energies:
 √s = 18 GeV and 27 GeV
 Au+Au collisions.
- Four weeks: 200 GeV U+U collisions
- Eleven weeks of spin physics at √s = 500 GeV
- Diffractive program, with transversely polarized beams and search for glueballs

Summary



- Enhanced STAR capabilities
 - Complete TOF system
 - New electronics for the BEMC =>low dead time
 - Improved operation efficiency
- AuAu 200 GeV run
 - Successful run with high luminosity and detector improvements
 - Exceeded all goals
 - Great performance by the collider
- Beam Energy Scan: AuAu 39, 7.7 and 11.5 GeV runs
 - Met all goals and far exceeded goals for some data points
 - Dramatic improvement of the collider performance at 7.7 GeV
- Preliminary results based on fast offline for the run 10 data sets look very promising